

WHAT IS CLAIMED IS:

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1. An image filling method comprising the steps of:

- separating a reference line drawing into first closed regions, said reference line drawing  
10 being read from a storage device and being an original line drawing of a reference picture;  
extracting at least one feature amount of said first closed regions other than the barycenter;  
separating a line drawing to be filled  
15 into second closed regions, said line drawing to be filled being read from a storage device;  
extracting at least one feature amount of said second closed regions other than the barycenter;  
20 calculating variations of feature amounts between every combination of said first closed regions and said second closed regions, sorting said first closed regions in ascending order by the variation of the feature amount for each of said  
25 second closed regions;  
generating color candidate lists for each of said second closed regions, wherein color information corresponding to said first closed regions is obtained from said reference picture and  
30 duplication of said color information is eliminated;  
and  
filling each of said second closed regions with a color which is on the top of said color candidate list corresponding to said second closed  
35 region.

2. The image filling method as claimed in claim 1, said step of separating said reference line drawing comprising the steps of:

initializing closed region data into a boundary value, said closed region data corresponding to each of pixels which constitute said reference line drawing, said boundary line being larger than the maximum closed region number;

initializing x, y coordinates and the closed region number when scanning of said reference line drawing is started, and scanning said reference line drawing;

when a scanned pixel is white and the closed region data of coordinates (x, y) of the scanned pixel is said boundary value, providing the closed region number as the closed region data to pixels of the closed region which includes the coordinates (x, y), wherein the coordinates is substituted into working coordinates and the closed region number is substituted into closed region data of the working coordinates while the working coordinates are moved one pixel by one pixel;

when the scanned pixel is not white or the closed region data of coordinates (x, y) of the scanned pixel is not said boundary value, incrementing the closed region number by 1; and

said step of separating said line drawing to be filled comprising the step of providing a closed region number as closed region data of each of closed regions.

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3. The image filling method as claimed in

claim 1, each of said steps of extracting at least one feature amount of said first closed regions and extracting at least one feature amount of said second closed regions comprising the steps of:

- 5                   initializing a minimum x coordinate, a minimum y coordinate, a maximum x coordinate and a maximum y coordinate of a rectangular circumscribing each of said closed regions;
- 10                   obtaining the minimum x coordinate, the minimum y coordinate, the maximum x coordinate and the maximum y coordinate of the rectangular circumscribing each of said closed regions; and
- 15                   calculating central coordinates of the rectangular circumscribing each of said closed regions as said feature amount from the minimum x coordinate, the minimum y coordinate, the maximum x coordinate and the maximum y coordinate .

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4. The image filling method as claimed in claim 1, each of said steps of extracting at least one feature amount of said first closed regions and extracting at least one feature amount of said second closed regions comprising the steps of:

- 25                   initializing a minimum x coordinate, a minimum y coordinate, a maximum x coordinate and a maximum y coordinate of a rectangular circumscribing each of said closed regions;
- 30                   obtaining the minimum x coordinate, the minimum y coordinate, the maximum x coordinate and the maximum y coordinate of the rectangular circumscribing each of said closed regions; and
- 35                   calculating an area of the rectangular circumscribing each of said closed regions as said feature amount from the minimum x coordinate, the

minimum y coordinate, the maximum x coordinate and the maximum y coordinate.

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5. The image filling method as claimed in claim 1, each of said steps of extracting at least one feature amount of said first closed regions and  
10 extracting at least one feature amount of said second closed regions comprising the steps of:  
initializing a minimum x coordinate, a minimum y coordinate, a maximum x coordinate and a maximum y coordinate of a rectangular circumscribing  
15 each of said closed regions;  
obtaining the minimum x coordinate, the minimum y coordinate, the maximum x coordinate and the maximum y coordinate of the rectangular circumscribing each of said closed regions; and  
20 calculating an aspect ratio of the rectangular circumscribing each of said closed regions as said feature amount from the minimum x coordinate, the minimum y coordinate, the maximum x coordinate and the maximum y coordinate.  
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6. The image filling method as claimed in  
30 claim 1, each of said steps of extracting at least one feature amount of said first closed regions and extracting at least one feature amount of said second closed regions comprising the steps of:  
initializing a number of pixels in each  
35 closed region; and  
scanning said closed region while incrementing the number by one such that the number

of pixels is obtained as said feature amount.

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7. The image filling method as claimed in claim 1, each of said steps of extracting at least one feature amount of said first closed regions and extracting at least one feature amount of said  
10 second closed regions comprising the steps of:

initializing a minimum x coordinate, a minimum y coordinate, a maximum x coordinate, a maximum y coordinate and a number of pixels of a rectangular circumscribing each of said closed  
15 regions;

scanning said closed region, and obtaining the minimum x coordinate, the minimum y coordinate, the maximum x coordinate and the maximum y coordinate of said closed region and incrementing  
20 the number of pixels one by one when closed region data of the pixels in said closed region is not said boundary value; and

calculating an area of the rectangular circumscribing each of said closed regions from the  
25 minimum x coordinate, the minimum y coordinate, the maximum x coordinate and the maximum y coordinate, dividing the region by the number of pixels for obtaining said feature amount.

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8. The image filling method as claimed in claim 1, each of said steps of extracting at least  
35 one feature amount of said first closed regions and extracting at least one feature amount of said second closed regions comprising the steps of:

initializing a peripheral length of each closed region;

setting a maximum number as a previous closed region data;

5 scanning said closed region;

incrementing each of peripheries of said previous closed region data and said closed region data by one, and substituting said closed region data into said previous closed region data when said closed region data of a scanned pixel is not the boundary value, said closed region data is smaller than the maximum value and said closed region data is not the same as said previous closed region data; and

15 obtaining said peripheral length of each closed region as said feature amount by repeating this process.

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9. The image filling method as claimed in claim 1, each of said steps of extracting at least one feature amount of said first closed regions and extracting at least one feature amount of said second closed regions comprising the steps of:

initializing a peripheral length and a number of pixels of each closed region;

25 setting a maximum number as a previous closed region data;

30 scanning said closed region;

incrementing the number of pixels when closed region data of a scanned pixel is not the boundary value;

35 incrementing each of peripheries of said previous closed region data and said closed region data by one, and substituting said closed region

data into said previous closed region data when said previous closed region data is smaller than the maximum value and said closed region data is not the same as said previous closed region data; and

5           obtaining said feature amount by dividing said peripheral length of said closed region by the square root of the number of pixels constituting said closed region.

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10. The image filling method as claimed in claim 1, said step of filling each of said second closed regions comprising:

15           substituting coordinates (x, y) in a second closed region into working coordinates; and  
              substituting a specified color value into said working coordinates when closed region data of  
20   said coordinates (x, y) is the same as closed region data of said second closed region data and the color of said coordinates (x, y) is different from the specified color, wherein a pixel of said working coordinates is moved one pixel by one pixel.

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11. The image filling method as claimed in claim 1, further comprising the steps of:

30           reading a filled line drawing, color candidates list and closed region data from a storage device;

              presenting said filled line drawing to a  
35   user;

              presenting said color candidate list corresponding to each closed region of said filled

line drawing according to a request by the user;

changing a color of a closed region which  
is specified by the user into a color which is  
selected by the user from said color candidate list;

5 and

storing said filled line drawing in which  
the color is changed.

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12. The image filling method as claimed in  
claim 11, further comprising the steps of:

generating a color alias list which has  
15 aliases corresponding to color information, and  
storing said color alias list in a storage device;

reading said color alias list from said  
storage device; and

providing color aliases to said color  
20 candidate list to be displayed.

25 13. An image filling method comprising the  
steps of:

extracting color information of each pixel  
of a line drawing to be filled, wherein said line  
drawing to be filled includes a colored line which  
30 is a boundary line dividing said line drawing to be  
filled into regions, a color of the boundary line  
specifying a color used for filling the boundary  
line;

extracting boundary line information  
35 representing whether said each pixel is on the  
boundary line or not by using said color  
information;



filling said line drawing except the  
boundary line by using said boundary line  
information; and

filling said colored line by using said  
5 boundary line information.

10 14. The image filling method as claimed in  
claim 1, further comprising the steps of:

extracting color information of each pixel  
of a line drawing to be filled, wherein said line  
drawing to be filled includes a colored line which  
15 is a boundary line dividing said line drawing to be  
filled into regions, a color of the boundary line  
specifying a color used for filling the boundary  
line;

extracting boundary line information  
20 representing whether said each pixel is on the  
boundary line or not by using said color  
information;

filling said line drawing except the  
boundary line by using said boundary line  
25 information; and

filling said colored line by using said  
boundary line information.

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15. The image filling method as claimed  
in claim 13, said step of extracting boundary line  
information comprising the steps of:

35 extracting color information of each pixel  
by scanning said line drawing to be filled;

comparing R, G, B values of said color

information with predetermined R, G, B thresholds;  
and

5                    setting codes according to the kind of  
said colored line and regions other than said  
boundary line.

10                   16. The image filling method as claimed in  
claim 14, said step of extracting boundary line  
information comprising the steps of:

                  extracting color information of each pixel  
by scanning said line drawing to be filled;

15                   comparing R, G, B values of said color  
information with predetermined R, G, B thresholds;  
and

                  setting codes according to the kind of  
said colored line and regions other than said  
20                   boundary line.

25                   17. The image filling method as claimed in  
claim 13, said step of filling said line drawing  
comprising the step of:

                  providing specified color information to a  
region which includes coordinates when said  
30                   coordinates are within said line drawing to be  
filled and said boundary line information of said  
coordinates represents a region other than the  
boundary line.

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18. The image filling method as claimed in claim 14, said step of filling said line drawing comprising the step of:

5 providing specified color information to a region which includes coordinates when said coordinates are within said line drawing to be filled and said boundary line information of said coordinates represents a region other than the boundary line.

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19. The image filling method as claimed in claim 13, said step of filling said colored line comprising the steps of:

when a pointing device is in a first state and boundary line information of coordinates at the pointing device represents a region other than the boundary line, obtaining color information of said coordinates at the pointing device; and

20 when the pointing device is in a second state and boundary line information of coordinates at the pointing device represents the boundary line, providing said obtained color information to said coordinates at the pointing device.

30

20. The image filling method as claimed in claim 14, said step of filling said colored line comprising the steps of:

35 when a pointing device is in a first state and boundary line information of coordinates at the pointing device represents a region other than the boundary line, obtaining color information of said

coordinates at the pointing device; and

when the pointing device is in a second state and boundary line information of coordinates at the pointing device represents the boundary line, providing said obtained color information to said coordinates at the pointing device.

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21. An image filling method comprising the steps of:

generating color specifying information including predetermined colors and corresponding names;

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displaying said color specifying information at coordinates when a user specifies a closed region by pointing said coordinates with a pointing device; and

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filling said closed region with a color specified by the user from said displayed color specifying information.

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22. The image filling method as claimed in claim 1, further comprising the steps of:

generating color specifying information including predetermined colors and corresponding names;

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displaying said color specifying information at coordinates when a user specifies a closed region by pointing said coordinates with a pointing device; and

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filling said closed region with a color specified by the user from said displayed color

specifying information.

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23. An image filling method comprising the steps of:

generating color specifying information  
including predetermined colors and corresponding  
10 names according to an instruction by a user;  
storing generated color specifying  
information in a storage device;  
reading a line drawing to be filled from  
said storage device;  
15 displaying said line drawing to be filled  
on a display;  
reading said color specifying information  
from said storage device;  
displaying said color specifying  
20 information at coordinates specified by a pointing  
device on the display by the user;  
filling a closed region which includes  
said coordinates with a color specified by the  
pointing device from said color specifying  
25 information; and  
storing said line drawing which is filled  
in the storage device.

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24. The image filling method as claimed in claim 1, further comprising the steps of:

generating color specifying information  
35 including predetermined colors and corresponding  
names according to an instruction by a user;  
storing generated color specifying

information in a storage device;  
reading a line drawing to be filled from  
said storage device;  
displaying said line drawing to be filled  
5 on a display;  
reading said color specifying information  
from said storage device;  
displaying said color specifying  
information at coordinates specified by a pointing  
10 device on the display by the user;  
filling a closed region which includes  
said coordinates with a color specified by the  
pointing device from said color specifying  
information; and  
15 storing said line drawing which is filled  
in the storage device.

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25. The image filling method as claimed in  
claim 23, said step of filling a closed region  
comprising the steps of:  
specifying a point in said closed region  
25 to be filled on the display with the pointing device,  
and obtaining coordinates of said point;  
judging whether said point of said  
coordinates is on said line drawing to be filled;  
displaying said color specifying  
30 information at said coordinates wherein said color  
specifying information is overlaid on said line  
drawing to be filled if said point of said  
coordinates is on said line drawing to be filled;  
specifying a color in said color  
35 specifying information which is displayed with the  
pointing device;  
obtaining a color value which is specified

from said color specifying information;  
filling said closed region including said  
coordinates with said color value;  
deleting said color specifying information  
5 from the display; and  
repeating these procedures until filling  
of said line drawing is completed.

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26. The image filling method as claimed in  
claim 24, said step of filling a closed region  
comprising the steps of:  
15 specifying a point in said closed region  
to be filled on the display with the pointing device,  
and obtaining coordinates of said point;  
judging whether said point of said  
coordinates is on said line drawing to be filled;  
20 displaying said color specifying  
information at said coordinates wherein said color  
specifying information is overlaid on said line  
drawing to be filled if said point of said  
coordinates is on said line drawing to be filled;  
25 specifying a color in said color  
specifying information which is displayed with the  
pointing device;  
obtaining a color value which is specified  
from said color specifying information;  
30 filling said closed region including said  
coordinates with said color value;  
deleting said color specifying information  
from the display; and  
repeating these procedures until filling  
35 of said line drawing is completed.

27. The image filling method as claimed in  
claim 25, said step of filling comprising the steps  
5 of:

saving said coordinates in working  
coordinates;

changing a color of said working  
coordinates into said color value when said working  
10 coordinates are within said line drawing to be  
filled and a color of said coordinates does not a  
boundary line color; and

changing colors of other coordinates  
around said coordinates into said color value.  
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28. An image processing method comprising  
20 the steps of:

inputting image data;

searching said image data for extracting a  
small region smaller than or equal to a  
predetermined size; and

25 outputting a list of said small regions.

29. The image filling method as claimed in  
claim 1, further comprising the steps of:

inputting image data which is said filled  
line drawing;

searching said image data for extracting a  
35 small region smaller than or equal to a  
predetermined size; and

outputting a list of said small regions.



5                   30. An image processing method comprising  
the steps of:  
                  inputting image data;  
                  searching said image data for extracting a  
small region smaller than or equal to a  
10   predetermined size;  
                  providing a mark to said small region; and  
                  displaying said mark wherein said mark is  
overlaid on said image data.

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                  31. The image filling method as claimed in  
claim 1, further comprising the steps of:  
20                   inputting image data which is said filled  
line drawing;  
                  searching said image data for extracting a  
small region smaller than or equal to a  
predetermined size;  
25                   providing a mark to said small region; and  
                  displaying said mark wherein said mark is  
overlaid on said image data.

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                  32. An image processing method comprising  
the steps of:  
                  inputting image data;  
35                   searching said image data for extracting a  
small region smaller than or equal to a  
predetermined size;

providing a mark to said small region; and  
displaying said mark wherein said mark is  
overlaid on said image data; and  
asking an user about processing for said  
5 small region such that processing specified by the  
user is performed.

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33. The image filling method as claimed in  
claim 1, further comprising the steps of:  
inputting image data which is said filled  
line drawing;  
15 searching said image data for extracting a  
small region smaller than or equal to a  
predetermined size;  
providing a mark to said small region; and  
displaying said mark wherein said mark is  
20 overlaid on said image data; and  
asking an user about processing for said  
small region such that processing specified by the  
user is performed.

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34. An image filling apparatus comprising:  
a storage device for storing image data;  
30 a part for reading said image data from  
said storage device;  
a part for separating a reference line  
drawing into first closed regions, said reference  
line drawing being read from said storage device and  
35 being an original line drawing of a reference  
picture;  
a part for extracting at least one feature

amount of said first closed regions other than the barycenter;

5 a part for separating a line drawing to be filled into second closed regions, said line drawing to be filled being read from said storage device;

a part for extracting at least one feature amount of said second closed regions other than the barycenter;

10 a part for calculating variations of feature amounts between every combination of said first closed regions and said second closed regions, sorting said first closed regions in ascending order by the variation of the feature amount for each of said second closed regions;

15 a part for generating color candidate lists for each of said second closed regions, wherein color information corresponding to said first closed regions is obtained from said reference picture and duplication of said color information is  
20 eliminated;

a part for filling each of said second closed regions with a color which is on the top of said color candidate list corresponding to said second closed region such that a filled line drawing  
25 is generated.

30 35. The image filling apparatus as claimed in claim 34, further comprising:

a part for storing said filled line drawing, corresponding color candidate lists and separated closed region in said storage device;

35 a part for reading said filled line drawing, color candidate lists and said closed region data from said storage device;

a part for presenting said filled line drawing to a user;

a part for presenting said color candidate list corresponding to each closed region of said filled line drawing according to a request by the user;

a part for changing a color of a closed region which is specified by the user into a color which is selected by the user from said color candidate list; and

a part for storing said filled line drawing in which the color is changed in said storage device.

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36. The image filling apparatus as claimed in claim 34, further comprising:

a part for generating a color alias list which has aliases corresponding to color information, and storing said color alias list in said storage device;

a part for reading said color alias list from said storage device; and

a part for providing color aliases to said color candidate list to be displayed.

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37. An image filling apparatus comprising:

a storage device for storing line drawings which includes a colored line which is a boundary line dividing said line drawing into regions, a color of the boundary line specifying a color used for filling the boundary line;

a part for reading a line drawing to be filled which includes said colored line from said storage device;

5 a part for extracting color information of each pixel of said line drawing to be filled,

a part for extracting boundary line information representing whether said each pixel is on the boundary line or not by using said color information;

10 a part for filling said line drawing except the boundary line by using said boundary line information; and

a part for filling said colored line by using said boundary line information.

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38. The image filling apparatus as claimed  
20 in claim 34, further comprising:

a storage device for storing said line drawing to be filled, wherein said line drawing to be filled includes a colored line which is a boundary line dividing said line drawing into  
25 regions, a color of the boundary line specifying a color used for filling the boundary line;

a part for extracting color information of each pixel of said line drawing to be filled,

a part for extracting boundary line  
30 information representing whether said each pixel is on the boundary line or not by using said color information;

a part for filling said line drawing except the boundary line by using said boundary line  
35 information; and

a part for filling said colored line by using said boundary line information.

5           39. The image filling apparatus as claimed  
in claim 37, said part for extracting boundary line  
information comprising:

          a part for extracting color information of  
each pixel by scanning said line drawing to be  
10   filled;

          a part for comparing R, G, B values of  
said color information with predetermined R, G, B  
thresholds; and

          a part for setting codes according to the  
15   kind of said colored line and regions other than  
said boundary line.

20           40. The image filling apparatus as claimed  
in claim 38, said part for extracting boundary line  
information comprising:

          a part for extracting color information of  
25   each pixel by scanning said line drawing to be  
filled;

          a part for comparing R, G, B values of  
said color information with predetermined R, G, B  
thresholds; and

30           a part for setting codes according to the  
kind of said colored line and regions other than  
said boundary line.

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41. The image filling apparatus as claimed

in claim 37, said part of filling said line drawing comprising:

5 a part for providing specified color information to a region which includes coordinates when said coordinates are within said line drawing to be filled and said boundary line information of said coordinates represents a region other than the boundary line.

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42. The image filling apparatus as claimed in claim 38, said part of filling said line drawing comprising:

15 a part for providing specified color information to a region which includes coordinates when said coordinates are within said line drawing to be filled and said boundary line information of said coordinates represents a region other than the boundary line.

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43. The image filling apparatus as claimed in claim 37, said part of filling said colored line comprising:

30 a part for obtaining color information of coordinates at a pointing device when the pointing device is in a first state and boundary line information of said coordinates at the pointing device represents a region other than the boundary line, and

35 a part for providing said obtained color information to coordinates at the pointing device when the pointing device is in a second state and

boundary line information of said coordinates at the pointing device represents the boundary line.

5

44. The image filling apparatus as claimed in claim 38, said part of filling said colored line comprising:

10           a part for obtaining color information of coordinates at a pointing device when the pointing device is in a first state and boundary line information of said coordinates at the pointing device represents a region other than the boundary  
15 line, and

          a part for providing said obtained color information to coordinates at the pointing device when the pointing device is in a second state and boundary line information of said coordinates at the  
20 pointing device represents the boundary line.

25           45. An image filling apparatus comprising:  
          a part for generating color specifying information including predetermined colors and corresponding names according to an instruction by a user;

30           a storage device;  
          a part for storing generated color specifying information in said storage device;  
          a part for reading a line drawing to be filled from said storage device;  
35           a part for displaying said line drawing to be filled on a display;  
          a part for reading said color specifying



information from said storage device;

a part for displaying said color specifying information at coordinates specified by a pointing device on the display by the user;

5 a part for filling a closed region which includes said coordinates with a color specified by the pointing device from said color specifying information; and

10 a part for storing said line drawing which is filled in the storage device.

15 46. The image filling apparatus as claimed in claim 34, further comprising:

a part for generating color specifying information including predetermined colors and corresponding names according to an instruction by a  
20 user;

a part for storing generated color specifying information in said storage device;

a part for reading a line drawing to be filled from said storage device;

25 a part for displaying said line drawing to be filled on a display;

a part for reading said color specifying information from said storage device;

30 a part for displaying said color specifying information at coordinates specified by a pointing device on the display by the user;

a part for filling a closed region which includes said coordinates with a color specified by the pointing device from said color specifying  
35 information; and

a part for storing said line drawing which is filled in the storage device.

5                   47. The image filling apparatus as claimed  
in claim 45, said part for filling a closed region  
comprising:

                  a part for specifying a point in said  
closed region to be filled on the display with the  
10 pointing device, and obtaining coordinates of said  
point;

                  a part for judging whether said  
coordinates are on said line drawing to be filled;

                  a part for displaying said color  
15 specifying information at said coordinates wherein  
said color specifying information is overlaid on  
said line drawing to be filled if said coordinates  
are on said line drawing to be filled;

                  a part for specifying a color in said  
20 color specifying information with the pointing  
device;

                  a part for obtaining a color value which  
is specified in said color specifying information;

                  a part for filling said closed region  
25 including said coordinates with said color value;

                  a part for deleting said color specifying  
information from the display; and

                  a part for repeating these procedures  
until filling of said line drawing is completed.

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                  48. The image filling apparatus as claimed  
35 in claim 46, said part for filling a closed region  
comprising:

                  a part for specifying a point in said

closed region to be filled on the display with the pointing device, and obtaining coordinates of said point;

- 5       a part for judging whether said coordinates are on said line drawing to be filled;
- a part for displaying said color specifying information at said coordinates wherein said color specifying information is overlaid on said line drawing to be filled if said coordinates
- 10   are on said line drawing to be filled;
- a part for specifying a color in said color specifying information with the pointing device;
- a part for obtaining a color value which
- 15   is specified in said color specifying information;
- a part for filling said closed region including said coordinates with said color value;
- a part for deleting said color specifying information from the display; and
- 20   a part for repeating these procedures until filling of said line drawing is completed.

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49. The image filling apparatus as claimed in claim 47, said part of filling comprising:

- a part for saving said coordinates in working coordinates;
- 30   a part for changing a color of said working coordinates into said color value when said working coordinates are within said line drawing to be filled and a color of said coordinates does not a boundary line color; and
- 35   a part for changing colors of other coordinates around said coordinates into said color value.

5                    50. An image processing apparatus  
comprising:  
                    a part for inputting image data;  
                    a part for searching said image data for  
extracting a small region smaller than or equal to a  
10     predetermined size; and  
                    a part for outputting a list of said small  
regions.

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                    51. The image filling apparatus as claimed  
in claim 34, further comprising:  
                    a part for inputting image data which is  
20     said filled line drawing;  
                    a part for searching said image data for  
extracting a small region smaller than or equal to a  
predetermined size; and  
                    a part for outputting a list of said small  
25     regions.

30                    52. An image processing apparatus  
comprising:  
                    a part for inputting image data;  
                    a part for searching said image data for  
extracting a small region smaller than or equal to a  
35     predetermined size;  
                    a part for providing a mark to said small  
region; and

a part for displaying said mark wherein  
said mark is overlaid on said image data.

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53. The image filling apparatus as claimed  
in claim 34, further comprising:

a part for inputting image data which is  
10 said filled line drawing;

a part for searching said image data for  
extracting a small region smaller than or equal to a  
predetermined size;

a part for providing a mark to said small  
15 region; and

a part for displaying said mark wherein  
said mark is overlaid on said image data.

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54. An image processing apparatus  
comprising:

a part for inputting image data;

25 a part for searching said image data for  
extracting a small region smaller than or equal to a  
predetermined size;

a part for providing a mark to said small  
region;

30 a part for displaying said mark wherein  
said mark is overlaid on said image data; and

a part for asking a user about processing  
for said small region such that processing specified  
by the user is performed.

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55. The image filling apparatus as claimed in claim 34, further comprising:

5 a part for inputting image data which is said filled line drawing;

a part for searching said image data for extracting a small region smaller than or equal to a predetermined size;

10 a part for providing a mark to said small region; and

a part for displaying said mark wherein said mark is overlaid on said image data; and

15 a part for asking a user about processing for said small region such that processing specified by the user is performed.

20 56. A computer readable medium storing program code for causing a computer to color images, said computer readable medium comprising:

program code means for reading said image data from said storage device;

25 program code means for separating a reference line drawing into first closed regions, said reference line drawing being read from said storage device and being an original line drawing of a reference picture;

30 program code means for extracting at least one feature amount of said first closed regions other than the barycenter;

program code means for separating a line drawing to be filled into second closed regions, 35 said line drawing to be filled being read from said storage device;

program code means for extracting at least

one feature amount of said second closed regions other than the barycenter;

program code means for calculating variations of feature amounts between every  
5 combination of said first closed regions and said second closed regions, sorting said first closed regions in ascending order by the variation of the feature amount for each of said second closed regions;

10 program code means for generating color candidate lists for each of said second closed regions, wherein color information corresponding to said first closed regions is obtained from said reference picture and duplication of said color  
15 information is eliminated;

program code means for filling each of said second closed regions with a color which is on the top of said color candidate list corresponding to said second closed region such that a filled line  
20 drawing is generated.

25 57. The computer readable medium as claimed in claim 56, further comprising:

program code means for storing said filled line drawing, corresponding color candidate lists and separated closed region in said storage device;

30 program code means for reading said filled line drawing, color candidate lists and said closed region data from said storage device;

program code means for presenting said filled line drawing to a user;

35 program code means for presenting said color candidate list corresponding to each closed region of said filled line drawing according to a

request by the user;

program code means for changing a color of a closed region which is specified by the user into a color which is selected by the user from said

5 color candidate list; and

program code means for storing said filled line drawing in which the color is changed in said storage device.

10

58. The computer readable medium as claimed in claim 56, further comprising:

15 program code means for generating a color alias list which has aliases corresponding to color information, and storing said color alias list in said storage device;

20 program code means for reading said color alias list from said storage device; and

program code means for providing color aliases to said color candidate list to be displayed.

25

59. A computer readable medium storing program code for causing a computer to color images, said computer readable medium comprising:

30 program code means for extracting color information of each pixel of a line drawing to be filled, wherein said line drawing to be filled includes a colored line which is a boundary line dividing said line drawing to be filled into regions,  
35 a color of the boundary line specifying a color used for filling the boundary line;

program code means for extracting boundary



line information representing whether said each pixel is on the boundary line or not by using said color information;

5       program code means for filling said line drawing except the boundary line by using said boundary line information; and

          program code means for filling said colored line by using said boundary line information.

10

60. The computer readable medium as claimed in claim 56, further comprising:

15       program code means for extracting color information of each pixel of a line drawing to be filled, wherein said line drawing to be filled includes a colored line which is a boundary line dividing said line drawing to be filled into regions,  
20   a color of the boundary line specifying a color used for filling the boundary line;

          program code means for extracting boundary line information representing whether said each pixel is on the boundary line or not by using said  
25   color information;

          program code means for filling said line drawing except the boundary line by using said boundary line information; and

30       program code means for filling said colored line by using said boundary line information.

35       61. The computer readable medium as claimed in claim 59, said program code means for extracting boundary line information comprising:

program code means for extracting color information of each pixel by scanning said line drawing to be filled;

5 program code means for comparing R, G, B values of said color information with predetermined R, G, B thresholds; and

program code means for setting codes according to the kind of said colored line and regions other than said boundary line.

10

62. The computer readable medium as claimed in claim 60, said program code means for extracting boundary line information comprising:

program code means for extracting color information of each pixel by scanning said line drawing to be filled;

20 program code means for comparing R, G, B values of said color information with predetermined R, G, B thresholds; and

program code means for setting codes according to the kind of said colored line and regions other than said boundary line.

25

30 63. The computer readable medium as claimed in claim 59, said program code means for filling said line drawing comprising:

program code means for providing specified color information to a region which includes

35 coordinates when said coordinates are within said line drawing to be filled and said boundary line information of said coordinates represents a region

other than the boundary line.

5

64. The computer readable medium as claimed in claim 60, said program code means for filling said line drawing comprising:

10       program code means for providing specified color information to a region which includes coordinates when said coordinates are within said line drawing to be filled and said boundary line information of said coordinates represents a region other than the boundary line.

15

65. The computer readable medium as claimed in claim 59, said program code means for filling said colored line comprising:

20       program code means for obtaining color information of coordinates at a pointing device when the pointing device is in a first state and boundary  
25       line information of said coordinates at the pointing device represents a region other than the boundary line, and

30       program code means for providing said obtained color information to coordinates at the pointing device when the pointing device is in a second state and boundary line information of said coordinates at the pointing device represents the boundary line.

35

66. The computer readable medium as claimed in claim 60, said program code means for filling said colored line comprising:

5       program code means for obtaining color information of coordinates at a pointing device when the pointing device is in a first state and boundary line information of said coordinates at the pointing device represents a region other than the boundary line, and

10       program code means for providing said obtained color information to coordinates at the pointing device when the pointing device is in a second state and boundary line information of said coordinates at the pointing device represents the

15       boundary line.

20       67. A computer readable medium storing program code for causing a computer to color images, said computer readable medium comprising:

      \ program code means for generating color specifying information including predetermined

25       colors and corresponding names according to an instruction by a user;

      \ program code means for storing generated color specifying information in a storage device;

      \ program code means for reading a line

30       drawing to be filled from said storage device;

      \ program code means for displaying said line drawing to be filled on a display;

      \ program code means for reading said color specifying information from said storage device;

35       program code means for displaying said color specifying information at coordinates specified by a pointing device on the display by the

user;

program code means for filling a closed region which includes said coordinates with a color specified by the pointing device from said color specifying information; and

5

program code means for storing said line drawing which is filled in the storage device.

10

68. The computer readable as claimed in claim 56, further comprising:

program code means for generating color specifying information including predetermined colors and corresponding names according to an instruction by a user;

15

program code means for storing generated color specifying information in a storage device;

20

program code means for reading a line drawing to be filled from said storage device;

program code means for displaying said line drawing to be filled on a display;

25

program code means for reading said color specifying information from said storage device;

program code means for displaying said color specifying information at coordinates specified by a pointing device on the display by the user;

30

program code means for filling a closed region which includes said coordinates with a color specified by the pointing device from said color specifying information; and

program code means for storing said line drawing which is filled in the storage device.

35

69. The computer readable medium as  
claimed in claim 67, said program code means for  
5 filling a closed region comprising:

program code means for specifying a point  
in said closed region to be filled on the display  
with the pointing device, and obtaining coordinates  
of said point;

10 program code means for judging whether  
said coordinates are on said line drawing to be  
filled;

program code means for displaying said  
color specifying information at said coordinates  
15 wherein said color specifying information is  
overlaid on said line drawing to be filled if said  
coordinates are on said line drawing to be filled;

program code means for specifying a color  
in said color specifying information with the  
20 pointing device;

program code means for obtaining a color  
value which is specified in said color specifying  
information;

program code means for filling said closed  
25 region including said coordinates with said color  
value;

program code means for deleting said color  
specifying information from the display; and

30 program code means for repeating these  
procedures until filling of said line drawing is  
completed.

35

70. The computer readable medium as  
claimed in claim 68, said program code means for

filling a closed region comprising:

program code means for specifying a point  
in said closed region to be filled on the display  
with the pointing device, and obtaining coordinates  
5 of said point;

program code means for judging whether  
said coordinates are on said line drawing to be  
filled;

program code means for displaying said  
10 color specifying information at said coordinates  
wherein said color specifying information is  
overlaid on said line drawing to be filled if said  
coordinates are on said line drawing to be filled;

program code means for specifying a color  
15 in said color specifying information with the  
pointing device;

program code means for obtaining a color  
value which is specified in said color specifying  
information;

20 program code means for filling said closed  
region including said coordinates with said color  
value;

program code means for deleting said color  
specifying information from the display; and

25 program code means for repeating these  
procedures until filling of said line drawing is  
completed.

30

71. The computer readable medium as  
claimed in claim 69, said program code means for  
filling comprising:

35 program code means for saving said  
coordinates in working coordinates;

program code means for changing a color of

said working coordinates into said color value when said working coordinates are within said line drawing to be filled and a color of said coordinates does not a boundary line color; and

5                   program code means for changing colors of other coordinates around said coordinates into said color value.

10

72. A computer readable medium storing program code for causing a computer to process images, said computer readable medium comprising:

15                   program code means for inputting image data;

                  program code means for searching said image data for extracting a small region smaller than or equal to a predetermined size; and

20                   program code means for outputting a list of said small regions.

25

73. The computer readable medium as claimed in claim 56, further comprising:

                  program code means for inputting image data which is said filled line drawing;

30                   program code means for searching said image data for extracting a small region smaller than or equal to a predetermined size; and

                  program code means for outputting a list of said small regions.

35



74. A computer readable medium storing program code for causing a computer to process images, said computer readable medium comprising:

5           program code means for inputting image data;

          program code means for searching said image data for extracting a small region smaller than or equal to a predetermined size;

10           program code means for providing a mark to said small region; and

          program code means for displaying said mark wherein said mark is overlaid on said image data.

15

75. The computer readable medium as claimed in claim 56, further comprising:

20           program code means for inputting image data which is said filled line drawing;

          program code means for searching said image data for extracting a small region smaller than or equal to a predetermined size;

25           program code means for providing a mark to said small region; and

          program code means for displaying said mark wherein said mark is overlaid on said image data.

30

35           76. A computer readable medium storing program code for causing a computer to process images, said computer readable medium comprising:

program code means for inputting image data;

program code means for searching said image data for extracting a small region smaller than or equal to a predetermined size;

program code means for providing a mark to said small region;

program code means for displaying said mark wherein said mark is overlaid on said image data; and

program code means for asking a user about processing for said small region such that processing specified by the user is performed.

15

77. The computer readable medium as claimed in claim 56, further comprising:

program code means for inputting image data which is said filled line drawing;

program code means for searching said image data for extracting a small region smaller than or equal to a predetermined size;

program code means for providing a mark to said small region; and

program code means for displaying said mark wherein said mark is overlaid on said image data; and

program code means for asking a user about processing for said small region such that processing specified by the user is performed.

35